

CLAIMS

What is claimed is:

- 5 1. A method of screening a library of materials for a rheological property, the method comprising:
- (a) providing a library of material samples supported in wells or on the surface of one or more substrates;
- 10 (b) at least partially contacting each sample of the library of samples with a contact portion of one or more probes;
- (c) moving the contact portion of the one or more probes relative to the each sample of the library of samples;
- (d) monitoring a parameter selected from power or force used to move the one or more probes or position amplitude, phase or
- 15 position time dependence of the one or more probes during the moving of the contact portion of the one or more probes; and
- (e) relating the parameter to a rheological property of the each sample of the library of samples.
- 20 2. A method as in claim 1 wherein the parameter is phase and amplitude of the one or more probes.
3. A method as in claim 1 wherein the parameter is phase or amplitude of the one or more probes at a constant force or power.
- 25 4. A method as in claim 1 further comprising analyzing the library of samples by comparing the rheological property of each of the samples to a desired value.
- 30 5. A method as in claim 1 wherein the rheological property is viscosity.

6. A method as in claim 1 wherein the one or more probes include a plurality of disposable probes.

7. A method as in claim 1 wherein the contact portion of the one or more probes includes a plurality of contact surfaces that are substantially planar relative to an axis of rotation of the probe.

8. A method as in claim 7 wherein the contact portion of the one or more probes is substantially disc-shaped.

9. A method as in claim 1 wherein moving the contact portion includes rotating the probe in an oscillatory manner or moving the probe according to a predetermined motion.

10. A method as in claim 1 wherein the monitoring step includes monitoring the power or force required to maintain a specific angular amplitude of the probe over time during the rotating of the probe.

11. A method as in claim 10 wherein the predetermined motion is a rotation of a predetermined number of degrees.

12. A method as in claim 1 wherein the force is torque used to move the one or more probes, rate of rotation of the probe or a combination thereof

13. A method as in claim 1 wherein the moving of the contact portion of the one or more probes is at least partially induced by a waveform generator.

14. A method as in claim 1 wherein the moving of the contact portion of the one or more probes is at least partially induced with a servo motor.

15. A method as in claim 1 wherein the library of samples include polymeric materials.

5 16. A method as in claim 1 wherein the library of samples include food formulations.

17. A method as in claim 1 wherein the library of samples include personal care formulations.

10 18. A method as in claim 1 wherein the library of samples include coating formulations.

15 19. A method as in claim 1 wherein the library of samples include rubber sheet or sample of predetermined shape.

20. A method as in claim 1 wherein the parameter for a first sample of the library of samples is monitored simultaneously with the monitoring of the parameter for a second sample of the library of samples.

20 21. A method as in claim 1 wherein the parameter for a first sample of the library of sample is monitored serially relative to the monitoring of the parameter for a second sample of the library of samples.

25 22. A method as in claim 1 wherein the step of providing the library of samples includes dispensing the library of samples with an automated system and elevating the temperature of the samples using the substrate.

30 23. A method as in claim 1 wherein the step of monitoring the parameter is accomplished at a rate of no greater than about 10 minutes per sample.

24. A method as in claim 1 wherein the monitoring step includes monitoring the parameter at multiple times over a particular period of time for determining changes to the rheological property over the particular period of time.

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25. A method as in claim 1 wherein the monitoring step includes monitoring the parameter at multiple different locations within each of the sample of the plurality of samples.

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26. A method of screening a library of materials for a rheological property, the method comprising:

(a) providing a library of at least 16 material samples supported in wells or on the surface of a substrate;

15 (b) at least partially contacting each sample of the library of samples with a contact portion of one or more probes;

(c) rotating the contact portion of the one or more probes in an oscillatory manner relative to the each sample of the library of samples according to electrical signals produced by a waveform generator;

20 (d) monitoring a parameter selected from power or force used to rotate the one or more probes or position, amplitude or position time dependence of the one or more probes during the rotating of the contact portion of the one or more probes; and

(e) relating the parameter to a rheological property of the each sample of the library of samples.

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27. A method as in claim 26 further comprising analyzing the library of samples by comparing the rheological property of each of the samples to a desired value.

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28. A method as in claim 26 wherein the rheological property is viscosity.

29. A method as in claim 26 wherein the one or more probes includes a plurality of disposable probes.

5 30. A method as in claim 26 wherein the contact portion of the one or more probes includes a plurality of contact surfaces that are substantially planar relative to an axis of rotation of the probe.

10 31. A method as in claim 30 wherein the contact portion of the one or more probes is substantially disc-shaped.

32. A method as in claim 26 wherein the rotating of the contact portion of the one or more probes is at least partially induced by a servo motor.

15 33. A method as in claim 26 wherein the signal from the waveform generator is selected from a sine wave electrical signal or a cosine wave electrical signal.

20 34. A method as in claim 26 wherein the step of rotating the contact portion includes employing circuitry for producing a predetermined rate of rotation.

25 35. A method as in claim 34 wherein the circuitry includes a lock-in amplifier.

36. A method as in claim 26 wherein the library of samples include polymeric materials.

30 37. A method as in claim 26 wherein the parameter for a first sample of the library of samples is monitored simultaneously with the monitoring of the parameter for a second sample of the library of samples.

38. A method as in claim 26 wherein the parameter for a first sample of the library of sample is monitored serially relative to the monitoring of the parameter for a second sample of the library of samples.

5 39. A method as in claim 26 wherein the step of providing the library of samples includes dispensing the library of samples with an automated system and elevating the temperature of the samples using the substrate.

10 40. A method as in claim 26 wherein the step of monitoring the parameter is accomplished at a rate of no greater than about 10 minutes per sample.

15 41. A method of screening a library of materials for rheological property, the method comprising:

 (a) providing a library of at least 16 material samples supported in wells or on the surface of a substrate;

 (b) at least partially contacting each sample of the library of samples with a contact portion of one or more probes wherein:

20 i) one or more actuators are attached to an automated system and at least selectively attached to the one or more probes; and

 ii) the automated system moves the one or more actuators and the one or more probes for contacting the each sample of the library of samples with the contact portion of the one or more probes;

25 (c) rotating the contact portion of the one or more probes in an oscillatory manner relative to the each sample of the library of samples with the one or more actuators, wherein:

 i) the contact portion of the one or more probes is rotated according to electrical signals produced by a waveform generator that is at least selectively in electrical communication with the one or more actuators;

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(d) monitoring a parameter selected from power or force used to rotate or oscillate the one or more probes or position, amplitude, phase or position time dependence of the one or more probes during the rotating and oscillating of the contact portion of the one or more probes; and

5 (e) relating the parameter to a rheological property of the each sample of the library of samples.

42. A method as in claim 41 wherein the rheological property is viscosity.

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43. A method as in claim 41, wherein the waveform generator is at least selectively in electrical communication with a motor of each of the one or more actuators.

15 44. A method as in claim 41 wherein the rotating of the contact portion of the one or more probes is at least partially induced by a servo motor.

20 45. A method as in claim 41 wherein the one or more probes includes a plurality of disposable probes.

46. A method of screening a material for a rheological property, the method comprising:

25 (a) providing a sample supported in a well or on the surface of a substrate;

(b) at least partially contacting the sample with a contact portion of one or more probes;

30 (c) rotating the contact portion of the one or more probes in an oscillatory manner relative to the sample according to electrical signals produced by a waveform generator;

(d) monitoring a parameter selected from torque used to rotate the one or more probes or rate of rotation or angle of rotation as a function of time

of the one or more probes during the rotating of the contact portion of the one or more probes;

(e) relating the parameter to a rheological property of the sample.

5 47. A method as in claim 46 further comprising analyzing the sample by comparing the rheological property of the sample to a desired value.

10 48. A method as in claim 46 wherein the rheological property is viscosity.

15 49. A method as in claim 46 wherein the contact portion of the one or more probes includes a plurality of contact surfaces that are substantially planar relative to an axis of rotation of the probe.

 50. A method as in claim 46 wherein the contact portion of the one or more probes is substantially disc-shaped.

20 51. A method as in claim 46 wherein the rotating of the contact portion of the one or more probes is at least partially induced by a servo motor.

25 52. A method as in claim 46 wherein the signal from the waveform generator is selected from a sine wave electrical signal or a cosine wave electrical signal.

30 53. A method as in claim 46 wherein the step of rotating the contact portion includes employing circuitry for producing a predetermined rate of rotation.

 54. A method as in claim 53 wherein the circuitry includes a lock-in amplifier.

55. A method as in claim 46 wherein the sample is polymeric.

56. A method as in claim 46 wherein the monitoring step includes
5 monitoring the parameter at multiple times over a particular period of time for
determining changes to the rheological property over the particular period of
time.

57. A method as in claim 46 wherein the monitoring step includes
10 monitoring the parameter at multiple different locations within the sample to
determine internal differences in rheology of the sample.

58. A system for screening a library of materials for a rheological
property, the system comprising:
15 a plurality of samples supported in wells or on a surface of a substrate,
the plurality of samples being fluidic;
one or more probes, each of the one or more probes including a
contact portion for at least partially contacting the plurality of samples;
an actuator for rotating the contact portion of the one or more probes in
20 an oscillatory manner relative to the plurality of samples;
a transducer for sensing a parameter selected from torque used to
rotate the one or more probes or rate of rotation of the one or more probes
wherein the parameter can be related to the rheological property of the
plurality of samples; and
25 an automated system for moving the one or more probes relative to the
plurality of samples.

59 A system as in claim 58 further comprising a computer sub-
system for relating the parameter to a rheological property of the sample.
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60. A system as in claim 58 further comprising a waveform
generator and a lock-in amplifier in communication with the actuator wherein

the waveform generator and the lock-in amplifier cooperatively produce an electrical signal, which assists in controlling the rotation of the contact portion of the one or more probes.

5 61. A system as in claim 58 wherein the automated system includes an X-Y-Z robot arm.

 62. A system as in claim 58 wherein the one or more probes are
10 formed of a plastic material.

 63. A system as in claim 58 wherein the contact portion of the one
or more probes includes a plurality of contact surfaces that are substantially
planar relative to an axis of rotation of the probe.

15 64. A system as in claim 63 wherein the contact portion of the one
or more probes is substantially disc-shaped.

 65. A system as in claim 58 wherein the actuator rotates the one or
more probes with power provided by a servo motor.
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 66. A system as in claim 58 wherein the actuator includes a fastener
for selectively attaching to the one or more probes and wherein the one or
more probes are disposable.

25 67. A system as in claim 58 wherein the transducer is a motion
sensor that senses angles of rotation of the one or more probes.

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